

# PATENT SPECIFICATION

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## (54) APPLICATION OF POLYETHYLENE AND/OR ETHYLENE COPOLYMER BACKINGS TO FLOOR COVERINGS

(71) We, IMPERIAL CHEMICAL INDUSTRIES LIMITED, Imperial Chemical House, Millbank, London SW1P 3JP, a British Company, do hereby declare

5 the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—  
 10 This invention relates to the application of polyethylene and/or ethylene copolymer backings to carpets, rugs or mats and particularly to floor coverings intended to be fitted in motor vehicles.  
 15 Polyethylene backings have been applied to car carpets by a process in which particles of polyethylene are sprinkled onto the reverse side of the carpet and then passed under radiant heaters. The heaters bring about fusion of the particles and on cooling they resolidify and bond to the surface of the carpet. This bond is not strong so that for example polyethylene backings applied in this way do not always provide a satisfactory means for anchoring the tufts of a tufted carpet. Such backings are in fact normally only intended to provide the carpet with a thermoformable stiffener which can be thermoformed to match the 20 contours of the floor of the car and hence constrain the carpet to fit neatly onto the irregular floor. When backings of this type have been applied to tufted carpets it has been usual to improve the bond between the 25 backing and the carpet by using an intermediate coating of an impact adhesive such as polyvinylacetate.

It has been proposed to apply backings comprising copolymers of ethylene and 30 vinyl acetate to the reverse sides of carpets by means of apparatus such as roller coaters or curtain coaters. Such apparatus forces molten copolymer into the fibres of the carpet so that on cooling a good adhesive bond is established between the carpet and 35

the backing. However, the apparatus is costly and little use has been made of these processes.

According to this invention we provide a process for the application of polyethylene and/or ethylene copolymer backings to carpets, rugs or mats which comprises

- (1) sprinkling over the reverse side of a carpet, rug or mat a powder comprising a mixture of (a) from 2 or preferably 3 to 12% by weight of a foaming agent composition which begins to decompose within the temperature range of 120 to 200°C, (b) at least 10% by weight of a polymeric component which consists of polyethylene and/or one or more copolymers of ethylene with up to 20% and preferably from 5 to 20% by weight (based on the weight of the copolymer) of one or more comonomers chosen from the group consisting of vinyl acetate and the methyl, ethyl or butyl esters of acrylic or methacrylic acids the polymeric component having a melt flow index of from 5 to 30 or preferably from 5 to 20 and (c) from 0 to 88 or preferably 87% by weight of one or more ingredients chosen to modify the physical properties of the backing or reduce the cost of the powder,
- (2) heating the powder to a temperature at which the mixture fuses and the foaming agent decomposes, and

(3) cooling the mixture so as to cause it to resolidify and form an adhesive bond to the carpet, rug or mat.

Melt flow index is measured in grams per 10 minutes according to the method of British Standard Number 2782: Part 1/105C/1956.

In order to achieve a good adhesive bond between the carpet, rug or mat and the backing, it has been found necessary to select the correct combination of foaming agent and melt flow index. A foaming agent composition which begins to decompose in the temperature range of 120 to 200°C should be chosen and preferably the

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- foaming agent composition should decompose in the temperature range of 130 to 170°C. A discussion of suitable foaming agent compositions is provided in Volume 47 Number 8 of the 1957 edition of "Kunststoffe" (see pages 446 to 455). Examples of preferred foaming agent compositions are benzene-1,3-disulphohydrazide, diphenyl sulphone-3,3'-disulphohydrazide and a diphenyl oxide-4,4'-disulphohydrazide and a mixture of azodicarbonamide and an activator. Activators are metal soaps such as zinc stearate or metal oxides such as zinc oxide or alumina or inert oxides of non-metals such as silica which enhance the efficiency of the foaming agent or lower the temperature at which it begins to decompose. The activator may be used in amounts of up to 5% by weight of the mixture. Preferably the mixture should contain from 3 to 7% by weight of foaming agent. The melt flow index of the polymeric composition should preferably be from 5 to 20. At temperatures within the range of 120 to 250°C, the ability of the foaming mixtures to penetrate the fibres of the floor covering to a useful extent appears to reach a maximum when the melt flow index of the polymeric component is between 5 and 20. It has been found that backings formed from a process involving sprinkling these mixtures onto the reverse side of a tufted carpet are normally quite capable of anchoring the carpet tufts securely in place.
- None of the ethylene copolymers used in the performance of this invention should comprise more than 20% by weight (based on the weight of the copolymer) of copolymerised comonomer because it has been found that it is difficult to obtain powders from such copolymers. It is possible to make the mixtures used in this invention by simply dry blending together powdered foaming agent composition and powdered polymeric component. However, better results can be achieved by using powders obtained by grinding melt blends made by melt blending the foaming agent composition and the polymeric component in an internal mixer such as a Banbury mixer. This technique is particularly desirable if it is desired to incorporate fillers into the mixture. Up to 25% by weight (based on the weight of the mixture) of a mineral filler such as clay, talc, silica, alumina, whiting or barium sulphate may be incorporated into the mixture. Wood flour may be used instead of a mineral filler.
- The stiffness of the backing becomes important where it is intended to fit the floor covering in a motor vehicle. Backings made from mixtures comprising polyethylene and foaming agents are quite stiff and if necessary the stiffness of backings comprising ethylene copolymers and foaming agents can be increased by incorporating into the mixture up to 60% by weight of the mixture of a polyethylene having a melt flow index preferably similar to that of the copolymer.
- The backings can be made more resistant to heat distortion by incorporating into the mixture up to 1% by weight of a cross-linking agent such as di-cumyl peroxide, 1,3-bis(tertiary butyl peroxyisopropyl) benzene or 2,5-dimethyl-2,5-di(tertiary butylperoxy) hexyne-3.
- Other additives such as petroleum waxes and tack resins may also be incorporated into the mixture. Examples of tack resins include the rosin family of resins usually obtained from conifers and in particular fully or partially hydrogenated wood rosin esters made by esterifying with for example glycerol or pentaerythritol. Other tack resins which may be used include various coumarone-indene resins, petroleum derived hydrocarbon resins, permanently fusible phenolic resins, copolymers of α methyl styrene with vinyl toluene, the materials described as "Formolite resins" in British Patent 1 116 551 and the polydiene resins discussed in the article "Hydrocarbon Resins in Paper Coatings" in Volume 53 No. 5 of "Industrial and Engineering Chemistry" pages 371 to 374 (May 1961).
- It is preferred that the powder should be capable of passing through a mesh of aperture size 1200 μm. Better results are achieved using powders capable of passing through a mesh of aperture size 600 μm.
- The invention is illustrated by the following examples which describes the application of a backing to a tufted carpet suitable for fitting in a motor vehicle.
- EXAMPLE 1.**
- A charge comprising 4% by weight of a foaming agent which was diphenyl oxide-4,4'-disulphohydrazide and 96% by weight of a copolymer of ethylene with 18% by weight (based on the weight of the copolymer) of vinyl acetate and having a melt flow index of 10 was melt blended in a Banbury mixer. The blend was cooled and ground into a powder which was capable of passing through a mesh whose apertures were 400 microns square. This powdered mixture was fed to a conventional vibrating plate sprinkler. A tufted carpet with its reverse side uppermost was passed under the sprinkler at a speed such that the sprinkler deposited powder evenly over the reverse side of the carpet at a rate of about 32 ounces per square yard (1.4 kg/m<sup>2</sup>). The carpet was then baked in a hot air oven for 10 minutes at 200°C so as to fuse the powdered mixture and cause the foaming agent to decompose. Finally the carpet was allowed to cool to ambient temperatures.



whereupon it was found to have a foamed backing which was sufficiently strongly bonded to the carpet so as to prevent the tufts from being easily pulled from out of the remainder of the carpet.

**EXAMPLE 2.**

A tufted carpet was provided with a housing according to the procedure of Example 1 modified as follows. The charge melt blended in the Banbury mixer comprised 3% by weight of azodicarbonamide, 1% by weight of zinc oxide and 96% by weight of a copolymer of ethylene with 12.5% by weight (based on the weight of the copolymer) of vinyl acetate and having a melt flow index of 4. The rate at which powder was deposited on the reverse side of the carpet was reduced to 24 ounces per square yard ( $1.05 \text{ kg/m}^2$ ). Prior to baking in the hot oven, the sprinkled powder was subjected to sufficient radiant heating to cause the particles of powder to melt so as to avoid the particles being blown about by air currents as the carpet enters the oven. The period of baking was reduced to 8 minutes.

On removing the carpet from the oven and allowing it to cool, it was found that it had been provided with a foamed backing which was sufficiently strongly bonded to the carpet so as to prevent the tufts from being easily removed from the carpet.

**EXAMPLE 3.**

A tufted carpet was provided with a backing according to the procedure of Example 2 except that the charge melt blended in the Banbury mixer comprised 3% by weight of azodicarbonamide, 1% by weight of zinc oxide, 0.5% of 1,3-bis(tertiary butyl peroxyisopropyl) benzene and 95.5% by weight of a polyethylene having a melt flow index of 20 and a density of 0.916. Again it was found that the tufted carpet had been provided with a stiff foamed backing which was sufficiently strongly bonded to the carpet to hold the tufts firmly in place although the bond was not as strong as could be obtained when ethylene/vinyl acetate copolymer was used instead of polyethylene.

It is also a feature of this invention to provide a floor covering, particularly a tufted carpet suitable for fitting in motor vehicles, which has a self-adhesive backing comprising a foamed polymeric component which consists of polyethylene and/or one or more copolymers of ethylene with from 5 to 20% by weight of one or more comonomers chosen from the group consisting of vinyl acetate and the methyl, ethyl or butyl esters of acrylic or methacrylic acids. By "self-adhesive", it is meant that the backing adheres to the reverse side of the floor covering without the need to employ a separate coating of for-

example a latex, impact or hot melt adhesive material.

**WHAT WE CLAIM IS:—**

1. A process for the application of polyethylene and/or ethylene copolymer backings to carpets, rugs or mats which comprises

(1) sprinkling over the reverse side of a carpet, rug or mat a powder comprising a mixture of (a) from 2 to 12% by weight of a foaming agent composition which begins to decompose within the temperature range of 120 to 200°C, (b) at least 10% by weight of a polymeric component which consists of polyethylene and/or one or more copolymers of ethylene with up to 20% by weight (based on the weight of the copolymer) of one or more comonomers chosen from the group consisting of vinyl acetate and the methyl, ethyl or butyl esters of acrylic or methacrylic acids and the polymeric component having a melt flow index of from 5 to 30 and (c) from 0 to 88% by weight of one or more ingredients chosen to modify the physical properties of the backing or reduce the cost of the powder,

(2) heating the powder to a temperature at which the mixture fuses and the foaming agent decomposes, and

(3) cooling the mixture so as to cause it to resolidify and form an adhesive bond to the carpet, rug or mat.

2. A process according to Claim 1 wherein the mixture comprises from 3 to 7% by weight of the foaming agent composition, wherein the polymeric component consists of polyethylene and wherein the melt flow index of the polyethylene is from 5 to 20.

3. A process according to Claim 1 wherein the mixture comprises from 3 to 7% by weight of the foaming agent composition, wherein the polymeric component consists of one or more copolymers of ethylene and wherein the melt flow index of the copolymer or copolymers of ethylene is from 5 to 20.

4. A process according to Claim 1 wherein the mixture comprises from 3 to 7% by weight of the foaming agent composition, wherein the polymeric component consists of polyethylene and one or more copolymers of ethylene and wherein the melt flow index of the polymeric component is from 5 to 20.

5. A process according to any one of the preceding claims wherein the foaming agent composition begins to decompose in the temperature range of 120 to 170°C and wherein the melt flow index of the polymeric component is from 5 to 20.

6. A process according to any one of the preceding claims wherein the mixture also comprises up to 25% by weight of barium sulphate.

7. A process according to any one of the

- preceding claims wherein the mixture also comprises up to 1% of a cross-linking agent.
8. A process according to any one of the preceding claims wherein the mixture comprises up to 5% by weight of a metal soap or a metal oxide or silica.
9. A process substantially as hereinbefore disclosed and illustrated by the Examples.
10. A carpet, rug or mat, suitable for fitting in motor vehicles, which has a self-adhesive backing comprising a foamed polymeric component which consists of polyethylene and/or one or more copolymers of ethylene with from 5 to 20% by weight of one or more comonomers chosen from the group consisting of vinyl acetate and the methyl, ethyl or butyl esters of acrylic or methacrylic acids.
11. A carpet, rug, or mat according to Claim 10 wherein the polymeric component consists of polyethylene.
12. A carpet, rug or mat according to Claim 11 wherein the polymeric component consists of one or more copolymers of ethylene.
13. A carpet, rug or mat according to any one of claims 10 to 12 wherein the polymeric component contains up to 25% by weight of barium sulphate.

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